Does a satisfying trip result in more future trips with that mode?

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Abstract: *Previous studies have indicated that travel satisfaction – the experience of emotions during a trip and the evaluation of this trip – can be affected by travel mode choice and other trip characteristics. However, as satisfactory trips might improve a person's attitudes toward the used mode, this can increase the possibility that this person chooses this mode for future trips. Hence, a cyclical process between travel mode choice and travel satisfaction might occur. In this study we analyse this process – using cross-sectional data – for respondents walking and cycling, as recent studies have indicated that active travel contributes to high levels of travel satisfaction. Based on a structural equation modelling approach, we examine leisure trips of respondents residing within the city of Ghent (Belgium). Results indicate that the evaluation of walking and cycling trips positively affect the respondents' stance toward the respective mode. However, this affect attenuates within a few days, suggesting that frequent satisfactory trips with a certain mode are necessary to permanently improve attitudes and possibly creating habitual travel patterns.*

Keywords: Travel satisfaction, travel mode choice, travel-related attitudes, structural equation modelling, Ghent (Belgium)

1. Introduction

Frequent walking and cycling have numerous positive effects on individuals and the society as a whole. First of all, active travel helps to reduce the negative effects of car dependency, such as congestion, air pollution and the risk of injury and death to road users (e.g., Ogilvie et al., 2004). Furthermore, the physical activity provided by active travel increases productivity and reduces obesity, blood pressure and the risk of several chronic health conditions, resulting in reduced health care costs (e.g., Humphreys et al., 2014; Sallis et al., 2004). Recent studies also indicate that people who walk or cycle experience and evaluate their trip more positively compared to people using public transport or the car (De Vos et al., 2014a, 2014b; Ettema et al., 2011; Friman et al., 2013; Olsson et al., 2013). This travel satisfaction can positively affect life satisfaction through the performance of - and satisfaction with - activities at the destination of the trip. Active travel also contributes to higher levels of mental health and psychological well-being compared to people using motorized travel (Martin et al., 2014).

Active travel mode use is often explained by ecological models, indicating that the frequency of walking and cycling is affected by multiple levels of influence, including intrapersonal, interpersonal and environmental variables (Saelens et al., 2003; Sallis et al., 2008). Personal socio-demographic variables, for instance, such as age, income and household car ownership all have negative effects on active travel use (Saelens et al., 2003). Environmental variables, especially neighbourhoods' physical characteristics, also have a clear influence on people walking and cycling. From this point of view, the 'walkability', or how a neighbourhood is suited for cycling and especially walking is important. Urban neighbourhoods are mostly characterized by a high walkability, indicating that these neighbourhoods have a high density and diversity (resulting in short average distances) and sizeable infrastructure for pedestrians and cyclists. Suburban neighbourhoods, on the other hand, have a lower level of walkability

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due to longer average distances - resulting from lower levels of density and land-use mixing - and lower connectivity because of bigger building blocks and more T-intersection and dead-end streets. Furthermore, infrastructure for walking and cycling is often lacking. Not surprisingly, people living in high-walkable neighbourhoods walk and cycle more frequently than people living in low-walkable neighbourhoods (Saelens et al., 2003; Sallis et al., 2004).
Individual values and attitudes also affect active travel use. People with a positive stance toward active travel or people preferring to live in a neighbourhood with a high walkability will walk and cycle more compared to people with a preference for motorized travel and a suburban way of life (De Vos et al., 2012; Schwanen and Mokhtarian, 2005). Finally, the choice of active travel modes can also be partly explained by utility theories. According to this theory, people will choose a travel mode that gives them the highest (weighted) utility based on elements such as travel costs and travel time. Since active travel is considerably cheaper than motorised travel, the use of public transport and car can be mainly attributed to substantial time profits due to long distances caused by physical characteristics of the built environment.
It is also possible, however, that the mode choice is affected by how people have experienced previous trips. Recent studies indicate substantial differences in how people perceive and evaluate their trip across various travel modes (De Vos et al., 2014a, 2014b; Ettema et al., 2011; Friman et al., 2013; Olsson et al., 2013), suggesting that travel satisfaction is an outcome of the mode choice decision. However, since individuals generally choose an activity that previously gave them satisfactory experiences (Aarts et al., 1998; Kahneman and Krueger, 2006), it is possible that people choose a travel mode based on satisfaction with previous trips. A satisfying trip might improve the attitude towards the used mode, resulting in a bigger chance of choosing that mode for a future trip. If people tend to repeat choosing the same travel mode due to previous satisfactory trips with that mode this could result in travel mode choices being made in a rather unconscious fashion, possibly shaping habitual patterns (Aarts et al., 1998; Verplanken et al., 1997).
In this paper we analyse to which degree mode choice can be regarded as a process rather than a decision resulting in a certain level of travel satisfaction. The way people perceive their trip can improve or diminish their stance toward the used mode, possibly affecting future mode choice decisions. In order to analyse the cyclical process between mode choice, travel satisfaction and travel-related attitudes of people walking and cycling to out-of-home leisure activities, we use a structural equation modelling approach. The paper is structured as follows. Section 2 presents a brief literature review on the relationship between mode choice, travel-related attitudes and travel satisfaction. Section 3 explains the proposed conceptual model while the key variables are described in Section 4. Section 5 explains the used methodology. Section 6 deals with the major results while discussion and conclusion are provided in Section 7.

2. Previous research

2.1 The relationship between mode choice and travel satisfaction

Recently, studies have started analysing the effect of travel on happiness and well-being. Within this context, travel satisfaction is the most important measure analysing this link (De Vos et al., 2013). Travel satisfaction comprises two dimensions; i.e., an affective dimension (referring to emotions experienced during a trip) and a cognitive dimension (referring to an evaluation of the trip) (Ettema et al., 2011). Recent studies have analysed how travel satisfaction differs according to the chosen travel mode, indicating that the experience of travel differs according to the mode people choose. Public transportation use results in the lowest levels of travel satisfaction, while people walking or cycling are most satisfied. Car use results in intermediate levels of travel satisfaction (De Vos et al., 2014a, 2014b; Ettema et

al., 2011; Friman et al., 2013; Olsson et al., 2013). How travel satisfaction with a particular mode can influence mode choice has only been examined to a limited degree. To the best of our knowledge, only two studies analysed this link. Abou-Zeid and Ben-Akiva (2012) state that a lower satisfaction with car use and a higher satisfaction with public transport use will incline a mode switch from car to public transport. According to Reibstein et al. (1980), overall satisfaction with bus trips has a significant effect on the frequency of bus use. It is reasonable to assume that people who experienced a positive trip with a certain travel mode have a higher probability of choosing that mode for a future trip compared to people who experienced their trip with this mode negatively.

Utility theories suggest that the experience of feelings and emotions during an activity is an outcome of the choice made in a certain decision process. From this point of view, satisfaction with travel can be regarded as the outcome of the mode choice decision. However, it is also possible that travel satisfaction, and the evaluation of travel in particular, can affect (future) mode choices. According to Kahneman and Krueger (2006), a retrospective evaluation of a past episode can affect the prospective choice of an alternative in order to maximize happiness (Figure 1) (De Vos et al., 2014a; Ettema et al., 2010; Kahneman et al., 1997; Kahneman and Krueger, 2006). In terms of travel satisfaction, it can be assumed that the evaluation of a trip (cognitive dimension) is a function of the emotions experienced during that trip (affective dimension).

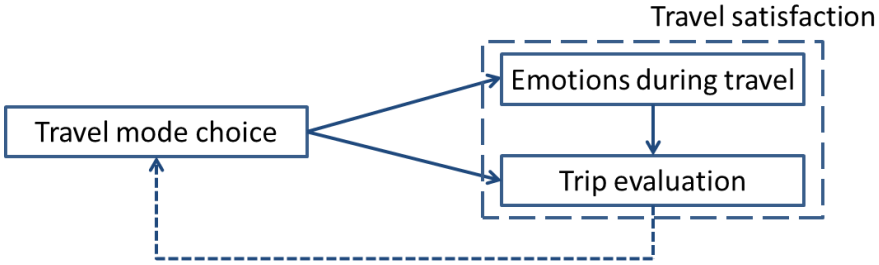

Figure 1. The link between travel mode choice and travel satisfaction.

2.2 The relationship between travel-related attitudes and mode choice

The relation between attitudes and mode choice has been examined rather frequently. Over the past two decades various studies have suggested that (travel-related) attitudes are important determinants of travel behaviour and mode choice (e.g., Bagley & Mokhtarian, 2002). A positive stance toward a certain mode of transportation will result in a higher use of that mode, as long as the use of this mode is not restricted by elements such as the built environment. This is not surprising, since attitudes (together with subjective norms and perceived behavioural control) are an important variable explaining people's intention to perform a given behaviour. These attitudes can also affect mode choice indirectly; individuals with an affinity toward a certain kind of travel will often choose a residential location that enables them to travel as much as possible with their preferred travel mode (e.g., Cao et al., 2007; De Vos et al., 2012; Handy et al., 2005).

Although most travel behaviour studies focus on the link from attitudes to mode choice, some studies also indicate that attitudes are conditioned by past behaviour. Attitudes and behaviour are mutually dependent on each other, whereby attitudes are conditioned by choices, while at the same time attitudes affect choices (Mokhtarian & Cao, 2008). It is therefore possible that mode choice affects travel-related attitudes. According to Reibstein et al. (1980) the frequency of bus use positively affects the attitude towards bus use. More recent studies found improving attitudes toward public transport after a mode-switching experiment from car use to public transport (Fujii et al., 2001; Fujii and Kitamura, 2003).

It is also possible, however, that there exists a cyclical process between travel-related attitudes and mode choice; a positive stance toward a certain mode can increase the use of that mode, while using that mode frequently might improve (or diminish) the attitude toward that mode. The relation between mode choice and attitudes might also be indirect through the perception and evaluation of that particular trip. Habitual drivers with negative perceptions of active travel might experience and evaluate their walking or cycling trip more positively than previously assumed, improving their stance toward these modes.

2.3 The relationship between travel satisfaction and travel-related attitudes

The link between travel satisfaction and travel-related attitudes has not yet been analysed thoroughly. The limited studies indicate that these attitudes can affect travel satisfaction. Positive attitudes toward bus use (Reibstein et al., 1980) and public transport in general (Abou-Zeid & Ben-Akiva, 2012) will positively affect the overall satisfaction of respectively bus use and public transport use. De Vos et al. (2014a) indicate that a positive attitude toward a certain mode has a positive effect on travel satisfaction when using that mode, especially on the cognitive evaluation of the trip. Although not analysed before, travel satisfaction could also influence travel-related attitudes. It is plausible that a satisfying trip with a certain mode will result in a more positive stance toward that specific mode. However, no studies to date have examined this link.

Since attitudes are an important determinant of travel mode choice and it is plausible that satisfaction with a trip can improve or diminish attitudes toward the used mode, attitudes might affect the link between mode choice and travel satisfaction as presented in Figure 1. We therefore include attitudes toward travel in the proposed cyclical process between mode choice and travel satisfaction.

3. Conceptual model

Based on the previous literature we construct a conceptual model analysing the possibility that a satisfying trip with a particular mode positively reinforces the probability of using that same mode for a future trip, through the improvement of attitudes toward that mode. This positive reinforcement can increase people's tendency to continue a certain behaviour, possibly resulting in the formation of habits in the long run (Aarts et al., 1998; Verplanken et al., 1997). In our model, travel mode choice affects travel satisfaction, which in turn influences travel-related attitudes (Figure 2). These attitudes will affect the future mode choices. In other words, this model examines whether travel satisfaction can affect future mode choices, through travel-related attitudes. The effect of attitudes on mode choice (i) and mode choice on travel satisfaction (ii) have been analysed in previous studies indicating that travel-related attitudes are important explanatory variables of mode choice and that mode choice has a significant effect on travel satisfaction levels. The influence of travel satisfaction on travel-related attitudes has not been analysed before.

In this model, where we focus on people walking and cycling, we also included respondents' residential location, socio-demographic variables and household car ownership as explanatory variables of travel mode choice. Since travel-related attitudes can affect the residential location choice (self-selection) we include this relationship in the model. Car ownership is considered as an important exogenous variable explaining travel mode choice. Since the medium-term decision of owning a car is influenced by long-term decisions such as the residential location choice, it can be argued that the built environment affects travel behaviour indirectly, through car ownership. Therefore, we included a link from respondents' residential location to household car ownership. We also included life satisfaction as an explanatory variable of travel satisfaction. Finally, we included links from socio-economic

and demographic variables to life satisfaction, travel mode choice, household car ownership, the residential location and travel-related attitudes.

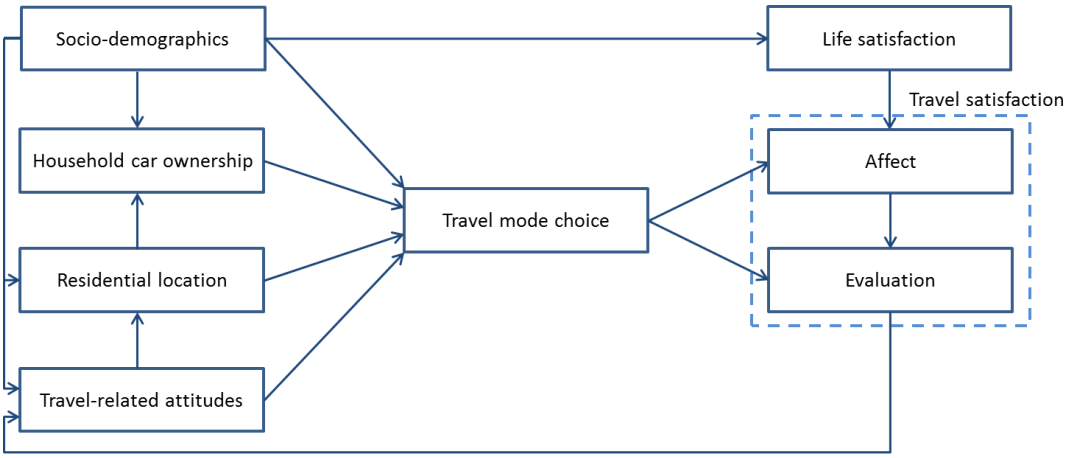

Figure 2. Conceptual model describing the relationships between attitudes, mode choice and travel satisfaction.

4. Data

For this study we use data from a 2012 Internet survey on travel behaviour, residential location (choice) and travel satisfaction. Invitations with a link to the Internet survey were distributed in five typical urban neighbourhoods (characterised by high density and high diversity) and seven typical suburban neighbourhoods (characterised by low density and a design oriented toward car use) within the city of Ghent, Belgium (250 000 inhabitants). In total, 27,780 invitations were distributed, one for every household in the selected neighbourhoods, covering about one fourth of all households in Ghent. Eventually, 1807 adult persons completed the survey, of which 1720 respondents were retained after data cleaning (Table 1). Although socio-economic variables of respondents are comparable to socio-economic variables of the total population of the selected neighbourhoods, the low response rate (6.5%) does not result in a representative sample making it impossible to perform a descriptive analysis of the population. However, since the main goal of this study is an analytical representation of relationships among multiple variables it is more important to have a large and sufficiently diverse sample.

In this study we use cross-sectional data, measuring respondents' attitudes, behaviour and experiences at one point in time. Since our model tries to measure how satisfaction with travel affects future travel choices, longitudinal data (i.e., repeated observations of the same variables over a certain period of time) would be most appropriate. Although the lack of longitudinal data in this study is a clear limitation, we do think that the cross-sectional data used in our model gives an indication of how travel satisfaction can influence future mode choices, through travel-related attitudes. This model can be seen as one piece of a repeated process (i.e., repetitive travel mode choices) where attitudes gradually change through the experience and evaluation of trips with a certain mode. These changes in attitudes can result in shifting intentions of choosing a particular mode. Although our model cannot show how people's attitudes evolve over time, it indicates how the stance toward a specific travel mode at a certain point in time is affected by travel satisfaction of one trip with that mode, while showing how these attitudes affect a specific mode choice decision.

Table 1. Socio-economic and demographic information of the respondents (*N* = 1720)

	%
Age	
18-30	23.9
31-45	28.0
46-60	27.0
> 60	21.2
Gender	
Female	45.7
Male	54.3
Household type	
Single	24.5
Single parent	3.9
Couple without children	38.0
Couple with children	28.2
Other	5.4
Household income	
Low (< 1750 euro)	17.9
Average (1750 – 3499 euro)	49.4
High (3500+ euro)	32.7
Education	
Low (lower than bachelor degree)	22.7
High (bachelor degree or higher)	77.3
Household car ownership	
0	21.9
1	52.6
> 1	25.5
Residential location	
Urban	57.6
Suburban	42.4

4.1 Key variables

4.1.1 Travel mode choice

Respondents were asked to indicate which travel mode (car; train; bus/tram/subway; bicycle or on foot) they used to reach their most recent out-of-home leisure activity. In the case they used more than one travel mode to reach their destination, they were asked to indicate the travel mode covering the longest distance. We used the most recent leisure trip (instead of the travel mode choice they usually use) because we also asked respondents to evaluate their trip. Doing so, we minimize the effect of distortions caused by the delayed recall and evaluation of experiences, and the skewing of memories of 'average' trips by extreme or unusual circumstances (Kahneman et al., 2004). For the same reason we also removed respondents performing their most recent leisure trip at least two days before filling in the survey, resulting in 880 respondents. Of the selected respondents, 46.3% used the car, 9.5% used public transport, 23.4% cycled, and 20.8% walked to their most recent leisure activity.

4.1.2 Travel satisfaction

In order to measure travel satisfaction of the respondents' most recent leisure trip, we use the Satisfaction with Travel Scale (STS) (Ettema et al., 2011). This scale measures the affective feelings based on two dimensions (i.e., valence: ranging from unpleasant to pleasant; and activation: ranging from deactivation to activation). The endpoints of each scale are combinations of the valence and activation dimensions. Six scales are being used; three of which range from negative deactivation to positive activation (i.e., bored - enthusiastic; tired - alert; fed up - engaged) and three of which range from negative activation to positive deactivation (i.e., stressed - calm; worried - confident; hurried - relaxed). A cognitive evaluation of the trip being made is measured by three scales referring to general quality and

efficiency of the trip (i.e., the trip was the worst I can think of – the trip was the best I can think of; the trip was very low standard – the trip was very high standard; the trip went very bad – the trip went very well). For all the nine scales, scores vary from -3 to 3 with a higher score implying higher satisfaction. Two factors (explaining 69.2% of total variance) – one affective and the other cognitive – can be extracted from the nine items using principal axis factoring and promax rotation (based on De Vos et al., 2014a, 2014b).

4.1.3 Travel-related attitudes

In order to measure respondents' attitudes and preferences toward different travel modes we first asked respondents to indicate to which degree they like to travel with different travel modes (car; bus or tram; train; bicycle; on foot) on a five-point Likert scale. The survey also asked respondents which of the following twelve positive aspects they linked with the use of the five travel modes (e.g., relaxing; cheap). For each travel mode we summed the number of positive aspects respondents indicated. Finally, five questions asked respondents to indicate (on a scale from 1 to 10) what their ideal neighbourhood looks like, from a travel-related perspective (e.g., a neighbourhood with good car accessibility). In order to detect attitudes towards specific travel modes we employed factor analysis. Since attitudes toward public transport do not load separately on one factor, we decided to exclude variables referring to public transport, resulting in ten variables. These variables were factor analysed (principal axis factoring; promax rotation) resulting in three factors (based on scree plot and eigenvalues larger than one) explaining 52.0% of total variance: Pro car (accessibility); Pro bicycling; and Pro walking.

4.1.4 Residential neighbourhood

Since we distributed survey invitations in two internally homogeneous sets of typical urban and suburban neighbourhoods within the city of Ghent, we have information on the residential neighbourhood of respondents, i.e., suburban (0) versus urban (1). The five urban neighbourhoods, built before the Second World War, have a high density (average density: 7,900 inhabitants per km^2), a high diversity, extensive public transport services and a street network stimulating active travel (i.e., small building blocks and a high connectivity). The seven suburban neighbourhoods, in most cases built after the Second World War, are characterized by low densities (average density: 1,700 inhabitants per km^2), low diversities, limited public transportation services, and a street network stimulating car use (i.e., large building blocks, T-intersections and dead-end streets) (for more details on the selected neighbourhoods, see De Vos et al., 2014a). For this study we retained 332 respondents living in suburban neighbourhoods and 548 respondents living in urban neighbourhoods.

4.1.5 Household car ownership, life satisfaction and socio-demographic variables

In the survey we asked respondents to indicate the number of cars their household owns. After removing respondents performing their activity at least two days ago, 18.4% of the selected respondents indicated that they do not possess a car, more than half of the respondents (53.9%) lives in a household with one car while 27.7% of the respondents lives in a household with more than one car.

Since the feelings experienced during a certain activity (such as a leisure trips) might also be affected by the overall life satisfaction of people, we also included a variable extracted from the five statements of the Satisfaction With Life Scale (SWLS) (Diener et al., 1985; Pavot & Diener, 1993). This scale asks respondents to which extent they agree with five statements (e.g., In most ways my life is close to my ideal). Since the internal consistency (reliability) of this scale is high (Cronbach's Alpha = 0.87), indicating a high correlation between the scale's items, we chose to create one life satisfaction variable by averaging the five items.

For this model, we included the following socio-demographic and economic variables: Age (year), Gender (0 = male; 1 = female), education (seven classes ranging from no degree to doctoral degree), household net income/month (six classes ranging from lower than 1000 euro to more than 4500 euro), and the presence of children (0 = no children younger than eighteen living at home; 1 = children younger than eighteen living at home).

5. Methodology

Structural equation modelling (SEM) is a research technique dating from the 1970s. Although at first mainly applied in economics, psychology, sociology and marketing research, SEM has also been used in travel behaviour studies since the 1980's (e.g., Bagley & Mokhtarian, 2002; Cao et al., 2007). SEM is a useful method for representing multiple relationships among a set of variables, where the same variable that is the outcome (dependent variable) in one set of relationships may be a predictor of outcomes (explanatory variable) in other relationships (Cao et al., 2007). The proposed models involve such multiple relationships among travel mode choice, travel satisfaction and travel-related attitudes.

Since outliers may affect the results of structural equation modelling it is important to detect and remove them. Based on the Mahalanobis distance, we excluded 40 outliers from the model on cycling (resulting in 840 respondents), while no outliers were detected for the model on walking (resulting in 880 respondents). We chose the maximum likelihood estimation approach, by far the most common estimation technique used in practice, to develop the SEMs in AMOS 22.0.

6. Results

In this section we will analyse the model presented in Figure 2, for both cycling and walking separately. Figures 3 and 4 show how attitudes, mode choice and travel satisfaction affect each other. A positive attitude toward cycling and walking will, as expected, positively affect the use of the respective modes. However, the pro cycling attitude affects cycling more than the pro walking attitude affects walking, suggesting that people are more often forced to walk than to cycle. As indicated in previous studies, active travel results in relatively high levels of travel satisfaction. People walking to their most recent leisure activity, however, experience and evaluate their trip more positively than people cycling. This is not a surprise since De Vos et al. (2014b), using the same data as this study, indicated that people walking experience more positive feelings and also evaluate their trip more positively compared to cyclists, who have rather intermediate levels of travel satisfaction. As a result, cycling has no significant effect on travel satisfaction in our model. For both walking and cycling, the emotions experienced during the trip – which are positively influenced by life satisfaction – strongly affect the cognitive evaluation of that trip, confirming the theory of Kahneman et al. (1997) and Kahneman and Krueger (2006) that the evaluation of an activity is a function of the emotions during that activity. Therefore, the positive evaluation of a walking trip is to a large extent explained by the feelings experienced during that trip, which can be regarded as a mediating variable between mode choice and the evaluation of the trip. Finally, Results also indicate that the evaluation of cycling and walking trips positively affect respectively pro cycling attitudes and pro walking attitudes. In sum, the results suggest that the conceptual model shown in Figure 2 is reasonable; travel satisfaction seems to affect travel mode choice, through travel-related attitudes.

Results also indicate that socio-economic and demographic variables affect household car ownership, the residential location and life satisfaction as expected. A high household income, for instance, positively affects household car ownership and life satisfaction, and increases the possibility of living in a suburb. Furthermore, younger people, respondents with high education and people living in a household without children have a bigger chance of living in

an urban neighbourhood. There also exist indirect effects of socio-demographics on household car ownership, through the residential location. Older people have a higher car possession because they have a bigger change of living in suburban neighbourhoods. Socio-demographics also affect attitudes toward cycling and walking, although not in a same way. People living in a household with children, for instance, have a relatively positive stance toward cycling but a relatively negative stance toward walking. Living in an urban neighbourhood significantly reduces the possibility of owning a car. A positive stance toward walking positively affects the chance of living in an urban neighbourhood and therefore also indirectly reduces the chance of owning a car and slightly increases the change of walking, suggesting a self-selection process. Cycling attitudes, on the other hand, do not significantly affect the residential location. Finally, the socio-demographics, household car ownership and the residential location affect mode choice. Since the relationships from socio-economic and demographic variables to the choice of an active travel mode are not significant and deteriorate the goodness-of-fit measures of the model, we excluded these links from the model. The socio-demographics do affect active travel use indirect, through car ownership, the residential location and travel-related attitudes. For instance, older people do not seem to use active travel a lot mainly because they often have relatively negative stance toward active travel, live in suburbs and (consequently) have a relatively high car ownership. The household car ownership and the residential location also affect the choice of walking and cycling, although not in a same fashion. Living in an urban neighbourhood significantly increases the chance of walking, while this positive effect is only indirect (through car ownership) for cycling. Car ownership has a significantly negative effect on cycling, but no effect on walking. This suggests that cycling is less affected by the built environment than walking, and that cycling can, to a certain degree, be regarded as a replacement of the car.

Since it is possible that the effect of the evaluation of a trip on the attitude toward the used mode reduces over time, we also analysed differences in the link from trip evaluation to attitudes between respondents who performed their most recent leisure activity recently (i.e., the same day or the day before they filled in the survey) (i.e., 51.6%), and respondents performing this activity two or more days before filling in the survey (i.e., 48.4%). Therefore, we performed the same structural equation model analysis – for walking and cycling – for respondents executing their leisure activity two or more days ago.[4] Results indicate that effect of trip evaluation on the mode-specific attitude is significantly lower for respondents filling in the survey at least two days after the leisure trip, compared to respondents filling in the survey one day after of the same day as the trip. For cyclists, the standardized direct effect from trip evaluation on pro cycling attitude reduces from 0.10 to 0.02 ($p > 0.1$), while for respondents walking the standardized effect of trip evaluation on the pro walking attitude reduces from 0.11 to 0.06 ($0.05 < p < 0.1$). This suggests that the tendency to choose the same mode due to satisfactory trips with that mode reduces over time. In order for mode choice decisions being made in a rather unconscious fashion – due habitual patterns – a frequent repetition of positive reinforcement (i.e., within a few days) seems necessary.

[4] Factor analyses of the STS items and the travel-related attitudes of respondents who performed their most recent leisure activity at least two days ago, resulted in the same factors as in Table 2 and 3, with the same variables loading most on the specific factors. The variables positive feelings and positive evaluation were constructed in the same way as indicated in section 4.1.2.

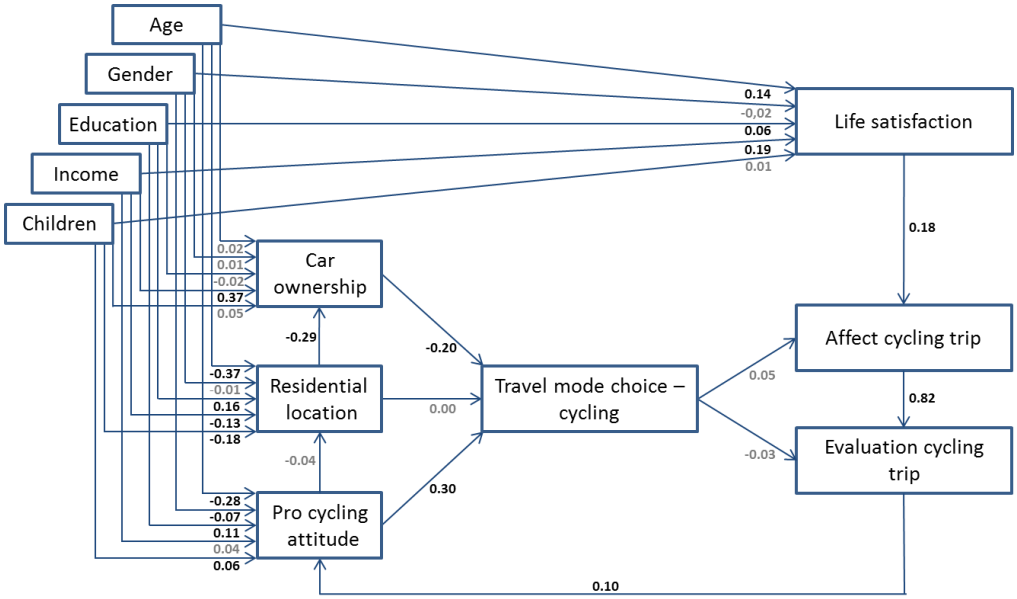

Figure 3. Standardized direct effects on the cycling model (black: significant at p < 0.1; grey: not significant at p < 0.1)

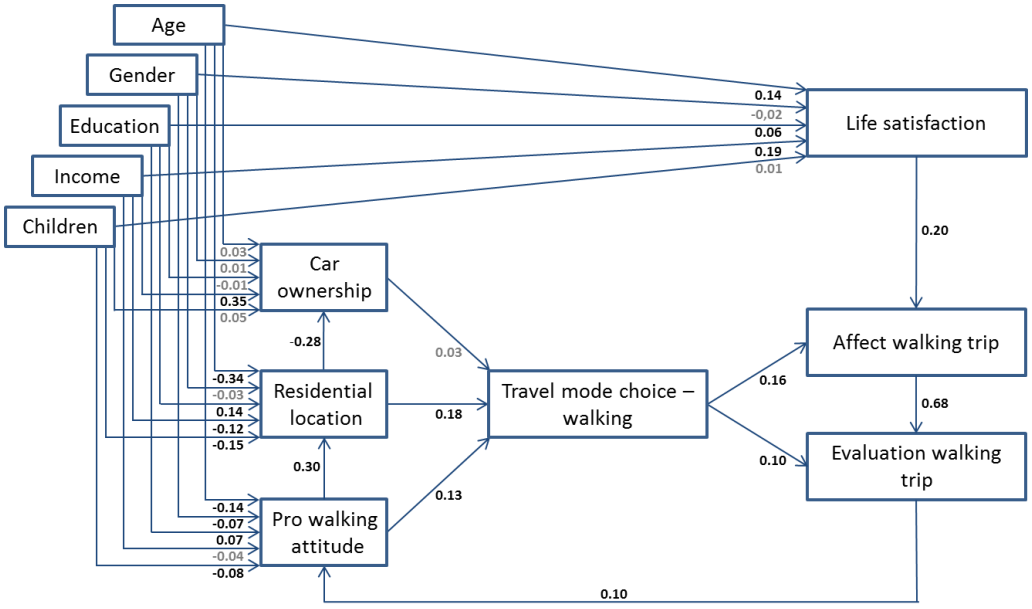

Figure 4. Standardized direct effects on the walking model (black: significant at p < 0.1; grey: not significant at p < 0.1)

7. Discussion and conclusion

The results of this study suggest that a cyclical process between travel mode choice and travel satisfaction exists. Travel mode choice affects travel satisfaction, while the evaluation of this trip affects mode-specific attitudes which in turn are an important explanatory variable of mode choice. This indicates that travel satisfaction should not only be regarded as an outcome of a mode choice, but that mode choice should also be regarded as an outcome of travel satisfaction. Although this study is based on cross-sectional data, making it impossible to capture changes in attitudes over time, results do suggest a cyclical process were positive reinforcement can improve mode-specific attitudes and possibly result in habitual behaviour.
This study indicates that travel mode choice is not only affected by elements such as the built environment and attitudes, but also by the satisfaction with previous trips. A satisfying trip

with a certain mode can improve the attitude toward that mode, increasing the chance of choosing that mode for a future trip. Since results indicate that the effect of trip evaluation on mode-specific attitudes attenuates within a few days, this suggests that positive reinforcement needs to be repeated regularly for habits to develop. These habits could result in a stronger link from behaviour to attitudes than from attitudes to behaviour. A positive stance toward walking and cycling might not necessarily lead to a high use of active travel modes. Due to strong habitual patterns, attitudes do not always result in effective behaviour ('value-action' gap). An individual who prefers to walk, for instance, may use the car for short distances due to strong general car habit (De Vos et al., 2012; Verplanken et al., 1997). In the case circumstances remain relatively stable, past travel choices contribute to the prediction of later travel behaviour (Bamberg et al., 2003). In order to unfreeze people's car habit it might therefore be better to impose direct changes in travel behaviour instead of gradually trying to change attitudes in favour of alternatives of the car. A temporary change in modal split may trigger lasting behavioural changes of habitual car drivers to public transport use, walking or cycling (Fujii and Kitamura, 2003). Such a decrease in car use could be obtained by offering free bus tickets or implementing road pricing. Since active travel is perceived and evaluated positively, resulting in improved attitudes toward walking and cycling and a bigger change of choosing active travel for future trips, it is important to eliminate constraints for active travel as much as possible in order to increase the use of active travel modes. One of the main reasons of people using motorised travel modes is that destinations are often not within reasonable walking or cycling distance. Therefore, it is important to adapt the built environment, for example by creating compact cities and Transit-oriented developments (TODs) were active travel (and public transport) is stimulated by high densities, high diversities and a high accessibility to public transport.

References

Aarts, H., Verplanken, B., van Knippenberg, A., 1998. Predicting behavior from actions in the past: repeated decision making or a matter of habit? Journal of Applied Social Psychology 28 (15), 1355-1374.

Abou-Zeid, M., Ben-Akiva, M., 2012. Travel mode switching: comparison of findings from two public transportation experiments. Transport Policy 24, 48-59.

Bagley, M.N., Mokhtarian, P.L., 2002. The impact of residential neighborhood type in travel behavior: a structural equation modeling approach. Annals of Regional Science 36 (2), 279-297.

Bamberg, S., Ajzen, I., Schmidt, P., 2003. Choice of travel mode in the theory of planned behavior: the roles of past behavior, habit, and reasoned action. Basic and Applied Social Psychology 25 (3), 175-187.

Cao, X., Mokhtarian, P.L., Handy, S.L., 2007. Do changes in neighborhood characteristics lead to changes in travel behavior? A structural equations modeling approach. Transportation 34 (5), 535-556.

De Vos, J., Derudder, B., Van Acker, V., Witlox, F., 2012. Reducing car use: changing attitudes or relocating? The influence of residential dissonance on travel behavior. Journal of Transport Geography 22, 1-9.

De Vos, J., Mokhtarian, P.L., Schwanen, T., Van Acker, V., Witlox, F., 2015a. Travel mode choice and travel satisfaction: bridging the gap between decision utility and experienced utility. Transportation. Accepted for publication.

De Vos, J., Schwanen, T., Van Acker, V., Witlox, F., 2013. Travel and subjective well-being: a focus on finding, methods and future research needs. Transport Reviews 33 (4), 421-442.

De Vos, J., Schwanen, T., Van Acker, V., Witlox, F., 2015b. How satisfying is the Scale for Travel Satisfaction? Transportation Research part F 29, 121-130.

Diener, E., Emmons, R.A., Larsen, R.J., Griffen, S., 1985. The satisfaction with life scale. Journal of Personality Assessment 49 (1), 71-75.
Ettema, D., Gärling, T., Eriksson, L., Friman, M., Olsson, L.E., & Fujii, S., 2011. Satisfaction with travel and subjective well-being: development and test of a measurement tool. Transportation Research Part F 14 (3), 167-175.
Ettema, D., Gärling, T., Olsson, L.E., & Friman, M., 2010. Out-of-home activities, daily travel, and subjective well-being. Transportation Research Part A 44 (9), 723-732
Friman, M., Fujii, S., Ettema, D., Gärling, T., Olsson, L.E., 2013. Psychometric analysis of the satisfaction with travel scale. Transportation Research Part A 48, 132-145.
Fujii, S., Kitamura, R., 2003. What does a one-month free bus ticket do to habitual drivers? Transportation 30 (1), 81-95.
Fujii, S., Gärling, T., Kitamura, R., 2001. Changes in drivers' perceptions and use of public transport during a freeway closure: effects of temporary structural change on cooperation in a real-life social dilemma. Environment and Behavior 33 (6), 796-808.
Handy, S.L., Cao, X., Mokhtarian, P.L., 2005. Correlation or causality between the built environment and travel behavior? Evidence from Northern California. Transportation Research Part D 10 (6) 427–444.
Humphreys, B.R., McLeod, L., Ruseski, J.E., 2014. Physical activity and health outcomes: Evidence from Canada. Health Economics 23 (1), 33-54.
Kahneman, D., Krueger, A.B., 2006. Developments in the measurement of subjective well-being. Journal of Economic Perspectives 20 (1), 3-24
Kahneman, D., Krueger, A.B., Schkade, D.A., Schwarz, N., Stone, A.A., 2004. A survey for characterizing daily life experience: the day reconstruction method. Science 306 (5702), 1776-1780.
Kahneman, D., Wakker, P.P., Sarin, R., 1997. Back to Bentham? Explorations of experienced utility. Quarterly Journal of Economics 112 (2), 375-405
wellbeing? Longitunial evidence from eighteen waves of the British Household Panel Survey. Preventive Medicine 69, 296-303.
Mokhtarian, P.L., Cao, X., 2008. Examining the impacts of residential self-selection on travel behavior: a focus on methodologies. Transportation Research part B 43 (3), 204–228.
Ogilvie, D., Egan, M., Hamilton, V., Petticrew, M., 2004. Promoting walking and cycling as an alternative to using cars: systematic review. BMJ.
Olsson, L.E., Gärling, T., Ettema, D., Friman, M., & Fujii, S., 2013. Happiness and satisfaction with work commute. Social Indicators Research 111 (1), 255-263.
Reibstein, D.J., Lovelock, C.H., Dobson, R.P., 1980. The direction of causality between perceptions, affect, and behavior: an application to travel behavior. Journal of Consumer Research 6 (4), 370-376.
Saelens, B.E., Sallis, J.F., Lawrence D.F., 2003b. Environmental correlates of walking and cycling: Findings from the transportation, urban design, and planning literatures. Annals of Behavioral Medicine 25 (2), 80-91.
Sallis, J.F., Frank, L.D., Saelens, B.E., Kraft, M.K., 2004. Active transportation and physical activity: opportunities for collaboration on transportation and public health research. Transportation research Part A 38 (4), 249-268.
Schwanen, T., Mokhtarian, P.L., 2005. What affects commute mode choice, neighbourhood physical structure or preferences toward neighborhoods? Journal of Transport Geography 13 (1), 83-99.
Verplanken, B., Aarts, H., Van Knippenberg, A., 1997. Habit, information acquisition, and the process of making travel mode choices. European Journal of Social Psychology 27 (5), 539-560.